

# THE IOWA NRCS NUTRIENT MANAGEMENT STANDARD (590)



## Managing....

- ✓ amount
  - ✓ source
  - ✓ placement
  - ✓ form
  - ✓ timing
- ....of nutrient and soil amendment application.



# THE NRCS NUTRIENT MANAGEMENT STANDARD

## What it is

The NRCS Nutrient Management Standard used in Iowa is the set of technical guidelines NRCS uses as it works with people who voluntarily manage nutrients wisely on their land.

## How it helps

Following the nutrient management standard helps both landowners and other Iowans as it:

- Budgets and supplies optimum nutrients for plant production.
- Uses manure or organic by-products properly as a plant nutrient source.
- Minimizes agricultural nonpoint source pollution of surface and groundwater resources.
- Maintains or improves the physical, chemical and biological condition of soil.

## Who uses it

Any producer who wants to do a better job of managing nutrients may benefit from using the principles of the 590 standard. A producer who must have an NRCS nutrient management plan will be asked to meet the 590 nutrient management standard.



Periodic soil sampling is one of the basic steps for sound nutrient management.

## Soil sampling and Lab Analysis (Testing)

At a minimum, obtain soil test analyses for phosphorus, potassium, and pH. All soil samples shall be collected according to Iowa State University (ISU) recommendations. See ISU PM-1 428C *Protecting Our Water Quality with Effective Soil Sampling*.

At a minimum, soil test once during a four-year period for continuous row crop or once during the cycle of other crop rotations that consist of close grown crops such as grasses and legumes. The sampling frequency for organic matter can be less frequent; every 12 years is recommended.

Use of the Late Spring Nitrate Test and Fall Corn Stalk Test is encouraged to help determine rates of nitrogen and/or evaluate the nitrogen management program. See ISU publications PM-1714 *Nitrogen Fertilizer Recommendations for Corn in Iowa* and PM 1584 *Corn Stalk Test to Determine Nitrogen*.

All soil tests shall be analyzed by a soil test lab certified according to Iowa Department of Agriculture and Land Stewardship (IDALS) soil test lab certification standards. See ISU Extension publication, PM-1310 (rev) *Interpretation of Soil Test Results*.

## Nutrient Application Rates

Nutrient application includes form, source, amount, timing and method of application on each field. Nutrients shall be applied to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.

Guidance for estimating realistic yield potentials is outlined in ISU-Extension Publication PM-1268 (rev) *Establishing Realistic Yields*. Realistic

yield potentials can be established based on soil productivity information, historical yield data, climactic conditions, level of management and/or local research on similar soils, cropping systems, and soil and manure/organic by-products tests. For new crops or varieties, industry yield recommendations may be used until documented yield data is available.

All nutrient applications shall be based on ISU recommendations for the soil type and crop to be grown unless specified in *Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source*. See ISU Extension Publications PM 1714 *Nitrogen Fertilizer Recommendations for Corn in Iowa*, PM1 688 *General Guide for Crop Nutrient Recommendations in Iowa*, PM 1811 *Managing Manure Nutrients for Crop Production* and PM 869 *Fertilizing Pasture*.

## Phosphorus and Potassium

- All nutrient values for phosphorus and potassium should be expressed in pounds of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O.
- Phosphorus and potassium application for crop and forage production (including non-crop areas) shall be based on soil test results.
- Phosphorus and potassium additions shall not exceed crop removal rates when soil test levels are optimum or above unless specified under *Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source*.

## Commercial Nitrogen

The amount of nitrate-nitrogen that moves below the crop root zone is directly related to nitrogen application rate. Do not overapply in an attempt to produce unrealistic yields.



Also, do not apply nitrogen in the fall with the following exceptions:

- 1) Anhydrous ammonia if:
  - mid-day soil temperature at 4" soil depth is not greater than 50°F and trending lower
  - soil moisture conditions are conducive to proper application and sealing
  - soil texture conditions favor the retention of applied nitrogen (anhydrous should not be applied to coarse soil type greater than 2 mm. on the USDA Textural Classification System).
- 2) Nitrogen application is associated with P and K products.
- 3) Nitrogen application is for production of winter grains.

Where the Late Spring Nitrate Test is not applicable, use the general recommendations for nitrogen found in Iowa State publications ISU PM-1714

*Nitrogen Fertilizer Recommendations for Corn in Iowa, ISU PM-869 Fertilizing Pasture, and ISU PM-1 584 Cornstalk Testing to Evaluate Nitrogen Management.*

### Adjust for contributions

Adjust all nutrient additions to account for contributions from legumes, manure or other organic nutrient sources.

- Legume contributions are shown in ISU Publication PM-1714 *Nitrogen Fertilizer Recommendations for Corn in Iowa.*
- Analyze manure for nutrient content of nitrogen, phosphorus and potassium each time the storage facility is emptied until a consistent trend is evident. Methods for sampling manure are shown in ISU Publication PM-1558 *How to Sample Manure for Nutrient Analysis.* If it is not practical to analyze the manure, use the values shown in ISU Publication PM-1811 *Managing Manure Nutrients for Crop Production.*

- When determining allowable nutrient application rates from manure or other organic sources, nitrogen may be applied based on crop nitrogen needs for that crop year. In most cases, this will allow application of more phosphorus and potassium than required by crop needs. Application based on crop nitrogen needs may continue unless otherwise specified under *Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source.*

For additional information on manure and other organic nutrient management refer to Standard and Specification Waste Utilization (633) and the Agricultural Waste Management Field Handbook. Soil pH shall be maintained at levels shown in ISU Publication PM-1688 General Guide for Crop Nutrient Recommendations in Iowa. For soil tests requiring less than 2000 pounds per acre ECCE, the lime requirement may be waived.

### Calibration of equipment

Application equipment for fertilizers and manure shall be calibrated at least annually to determine actual applied rates. After calibration, adjustments can be made in the application process to meet the planned or intended rates. All specifications will be consistent with federal, state, and local regulations.

### Application Timing

The timing of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, field accessibility, manure storage capacity and application equipment constraints.

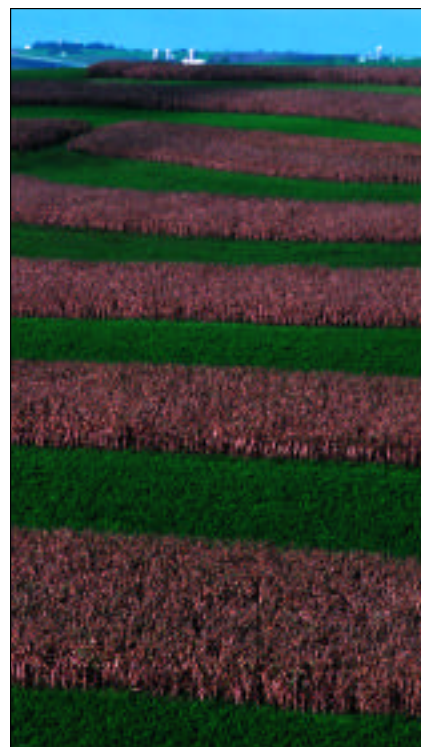
### Application Methods.

Commercial nutrients and organic nutrient sources shall not be surface applied to frozen, snow covered ground, or saturated soil if a potential risk for runoff exists. A potential risk

for runoff exists on slopes greater than 5% unless erosion is controlled to tolerable levels or less. Manure may be surface applied to frozen, snow covered or saturated ground only under one of the following conditions.

- Where storage capacity is limited or non existent, manure may be applied to frozen, snow covered, or saturated ground when storage facilities are full.
- On an emergency basis.

Manure surface applied to frozen, snow covered, or saturated ground shall be based on a manure disposal plan. That plan shall include: 1) under what circumstances the manure may be applied to frozen, snow covered, or saturated ground. (For example, storage capacity exceeded) 2) Rates of application 3) area of application and 4) other requirements such as runoff control as indicated through the use of the Phosphorus Index assessment tool.



*Adjusting application for nutrients already in the soil from legumes is an important part of proper nutrient management.*

## **Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source**

### **Nutrient Application Rates**

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance:

#### **Nitrogen**

When determining allowable nutrient application rates from manure or other organic sources, nitrogen may be applied based on crop nitrogen needs for that crop year. In most cases, this will allow application of more phosphorus and potassium than required by the crop. This may continue as long as the risk of phosphorus moving to surface waters based on the Iowa Phosphorus Index is very low or low. When the plan is being implemented on a phosphorus standard, manure or other organic by-products shall be applied at rates consistent with the phosphorus standard. In such situations, an additional nitrogen application, from nonorganic sources, may be required to supply the recommended amounts of nitrogen. Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in the harvested portion of the crop that is removed from the field in that growing season.

#### **Phosphorus**

When manure or other organic byproducts are used, the planned rates of phosphorus application shall be determined with reference to the Iowa Phosphorus Index (Agronomy Technical Notice 25). The Iowa Phosphorus Index (PI) assesses the potential for phosphorus movement from a field to surface water, and designates fields as very low risk, low risk, medium risk, high risk, and very high risk. Conservation practices and/or phosphorus management practices can be adopted that reduce the risk of phosphorus movement and

may reduce the risk rating on the field. If a field is rated very low risk, low risk, or medium risk by the index, the application of manure or organic byproducts may be made based on the nitrogen needs of the crop as noted previously. If a field is rated in the medium risk category, planned conservation and phosphorus management practices should not increase the rating of the field above the medium risk category. If a field is rated high risk or very high risk by the index:

- Manure or organic by-products may be applied to meet the needs of the planned crop rotation for phosphorus removal if conservation practices and/or phosphorus management practices are adopted to reduce the risk of phosphorus movement.
- Do not exceed nitrogen application limits based on crop needs.

#### **Sensitive Areas**

Manure and other organic nutrient sources shall not be applied to the following areas unless injected or incorporated within 24 hours:

- within 200 feet of sinkholes, drainage wells, or other direct conduits to the groundwater.
- within 200 feet of lakes, ponds, or other perennial water bodies.
- on land that floods more than once every 10 years. (inject or incorporate within 24 hours during the peak flood periods of April, May, June, and July).

### **Field Risk Assessment**

When animal manure or other organic byproducts are applied, a field-specific assessment of the potential for phosphorus transport from the field shall be completed. This assessment may be done using the Iowa Phosphorus Index assessment tool. The nutrient management plans shall include:

- a record of the assessment rating for each field or sub-field, and
- information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.

When such assessments are made, the results of the assessment and recommendations shall be discussed with the producer during the development of the nutrient management plan.

#### **Heavy Metals Monitoring**

When sewage sludge is applied, the application of potential heavy metal pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, Iowa Administrative Code (IAC) IA567-67, IAC567-120, and IAC567-121.

## **Additional Criteria to Minimize Agricultural Non- point Source Pollution of Surface and Ground Water Resources.**

In areas with an identified or designated phosphorus-related water quality impairment, an assessment shall be completed of the potential phosphorus transport from the field. These areas are the waters identified in the Iowa Department of Natural Resources (DNR) Iowa 303(d) list as impacted by phosphorus. This listing can be found on the DNR home page at <http://www.state.ia.us/epd/wtresrce/303dnote.htm>.

The Iowa Phosphorus Index (PI) shall be used to make these assessments. The results of these assessments and recommendations shall be discussed with the producer and included in the nutrient management plan.



*Conservation measures are important in minimizing phosphorus movement from a field.*

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In fields with a current soil test phosphorus level in the very high range as shown in ISU Publication PM-1688

*General Guide for Crop Nutrient*

*Recommendation in Iowa* or when soil losses exceed the tolerable levels, an assessment shall be completed of the potential phosphorus transport from the field. See Agronomy Technical Note 25, *Iowa Phosphorus Index*.

If a field is rated high risk or very high risk by the Iowa PI:

- Fertilizer may be applied to meet the needs of the planned crop rotation for phosphorus removal if conservation practices and/or phosphorus management practices are adopted to reduce the risk of phosphorus movement.
- Nitrogen application limits to meet the Nitrogen needs of the current crop should not be exceeded.

In areas where Karst topography or sandy soils pose a risk to ground water resources an assessment of the leaching risk will be made with a Nitrogen Leaching Index. Under high-risk categories follow this criteria:

- commercial nitrogen fertilizer for spring seeded crops shall not be fall applied.
- on sandy soils with high permeability (greater than 2 inches per hour), nitrogen shall be applied using split spring preplant, pre-emergent and/or post applications to provide distribution of nutrients at a time when plants will utilize the nutrients.

## Additional Criteria to Improve the Physical, Chemical, and Biological Condition of the Soil.

Nutrients shall be applied in a manner that does not degrade the soil's structure, chemical properties, or biological condition. Nutrients shall not be applied to flooded or saturated soils when the potential for soil compaction and creation of ruts is high.

## Considerations

Items to be considered during the planning process, but are not a required component of the nutrient management plan:

1. Sediment from soil erosion transports attached nutrients to offsite locations. Planning and applying conservation practices to reduce soil erosion also reduces offsite nutrient impacts.

2. Evaluate the effect of nutrient source characteristics such as nutrient content, solubility, leachability, mobility, adsorption, and volatility on plant growth and production and how it affects the nutrient budget. Consider effects of seasonal water budget on nutrient balances or potential loss from the plant environment.

3. Spring preplant, sidedress, and split applications of nitrogen are recommended for corn production. Use of the Late Spring Nitrate Test and Fall Corn Stalk Test is also encouraged including when corn is grown after forage, legumes and on manured soils.

4. Maintenance of good soil tilth will make plant nutrient absorption more efficient. Good tilth will reduce the need to apply fertilizer in order to overcome poor root development. See Conservation Cropping Sequence Standard (practice code 328).

5. In years of normal fertilizer application and unexpected low yields, excess nutrients can accumulate in the soil. Unused nitrogen can leach and pollute water supplies. Consider the available nitrogen and use the Late Spring Nitrate Test to determine available nitrogen. Establishing a winter cover crop can reduce the amount of nitrogen available for leaching by tying up unused nitrogen and recycling to later crops, but can reduce soil moisture in the spring causing establishment problems for succeeding crops.

6. It is important to keep pH in the proper range. To some degree, soil pH has an effect on the availability of almost all of the essential elements.

7. Assess the site characteristics such as soil, geology, depth to water table, proximity to surface water, topography, climate, odor considerations for other rural residents, and sensitive environmental elements.

8. Assess the effect nutrient applications have on site characteristics using leaching indices or other tools.

9. As soil tests for phosphorus and potassium increase from "very low" to "very high", the probability of an economic response to additional fertilizer decreases. There is a high probability there will be a large economic response to the addition of fertilizer to a field testing "very low". Nutrient additions to fields testing "high" to "very high" in phosphorus or potassium may be postponed without short-term effects on crop production.

10. In determining nitrogen availability for crops, consider application methods and losses.

11. Because of potential economic and environmental loss, consider risks of fall-applying anhydrous ammonia.

12. As new technology is developed consider feed management activities that may reduce the nutrient content of manure. Feed management may include phase feeding, amino acid supplemented low crude protein diets, use of low phytin phosphorus grain and enzymes such as phytase.



Nutrient application will vary by soil, crop, and nutrient content.



## Nutrient Management Plans and Specifications

Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve production goals and to prevent or minimize water quality impairment. Nutrient management plans shall comply with federal, state, and local laws and regulations and meet policy requirements of the NRCS General Manual (Title 450, part 401.03 and Title 190, part 402); NRCS Field Office Technical Guide; NRCS National Planning Procedures Handbook and NRCS Agronomy Manual. Persons who develop or approve nutrient management plans, including producers, certify the plans through a certification process approved by NRCS. Include the following components in the nutrient management plan:

- aerial photograph or map and a soil map of the site,
- current and/or planned plant production sequence or crop rotation,
- results of soil, plant, water, manure or organic by-product sample analyses,
- realistic yield potential for the crops in the rotation,
- quantify all nutrient sources,
- recommended nutrient rates, timing, form, and method of application and incorporation,
- location of designated sensitive areas or resources and the associated nutrient management restriction.

## Operation and Maintenance

The client is responsible for safe use and maintenance of this practice including:

- 1) guidance for implementation, operation, maintenance, recordkeeping, and complete field by field nutrient budget for nitrogen, phosphorus, and potassium for the rotation or crop sequence.
- 2) a statement that the plan was developed based on the requirements of the current standard and any applicable Federal, state, or local regulations or policies; and that changes in any of these requirements may necessitate a revision of the plan. In addition to the requirements described above, plans for nutrient management shall include:

- discussion about the relationship between nitrogen and phosphorus transport and water quality impairments. Include information about nitrogen leaching into shallow groundwater and potential health impacts. Information on phosphorus should include warnings on phosphorus accumulation in the soil, the increased potential for phosphorus transport in soluble form, and the types of water quality impairment that could result from phosphorus in surface water bodies.
- identify the size of the land base needed to enable plan implementation based on phosphorus, even when initial implementation will be based on nitrogen, unless other provisions not involving land application are made for using the manure.
- discussion about how the plan is intended to prevent nitrogen and phosphorus supplied for production purposes from contributing to water quality impairments.
- periodic plan review to determine if adjustments are needed. As a minimum, plans will be reviewed and revised with each soil test cycle.
- protection of fertilizer and organic by-product storage facilities from weather and leakage or spillage.
- calibration of application equipment to provide even application of fertilizer and manure at intended rates.
- documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed recommended and planned rates, records will indicate the reasons for the differences.
- maintaining records to document plan implementation. As applicable, records include soil test results and recommendations for nutrient application, quantities, analyses and sources of nutrients applied, dates and methods of nutrient applications, crops planted, planting and harvest dates, yields, and crop residues removed, results of water, plant, and organic by-product analyses, and dates of review and person performing the review, and recommendations that resulted from the review. Records should be maintained for five years, or longer

than five years if required by other Federal, state or local ordinances, or program or contract requirements.

## Safety

Workers should be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Take extra caution when handling ammonia sources of nutrients or organic wastes stored in unventilated enclosures.

Dispose of material generated by cleaning nutrient application equipment properly. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas at high risk for runoff and leaching.

## References

- At County Extension Offices; Extension Distribution Center, Printing Building, Iowa State University, Ames, IA50011; and several on the ISU Publications Home page at <http://www.extension.iastate.edu/Pages/pubs/>
- ISU PM-1428C *Protecting Our Water Quality with Effective Soil Sampling*
  - ISU PM-1310 *Interpretation of Soil Test Results*
  - ISU PM-1714 *Nitrogen Fertilizer Recommendations for Corn in Iowa*
  - ISU PM-1688 *General Guide for Crop Nutrient Recommendations in Iowa*
  - ISU PM-869 *Fertilizing Pasture*
  - ISUPM-1268(rev) *Establishing Realistic Yields*
  - ISU PM-1584 *Cornstalk Testing to Evaluate Nitrogen Management*
  - ISU PM-1436 *Nitrogen Fertilizer Management for Northeast Iowa*
  - ISU PM-569 *Warm-Season Grasses for Hay and Pasture*
  - ISU PM-1811 *Managing Manure Nutrients for Crop Production*
  - ISU PM-1558 *How to Sample Manure for Nutrient Analysis*

On the NRCS Fort Worth Home page at <http://www.ftw.nrcs.usda.gov/awmfh.html>  
Agricultural Waste Management Field Handbook

On the Iowa NRCS home page at: <http://www.ia.nrcs.usda.gov>  
**Iowa Technical Note 25, Iowa Phosphorus Index Background and Basic Concepts of the Phosphorus Index Phosphorus Index Calculator (Excel Spreadsheet) Waste Utilization Standard (633) Nutrient Management Standard 590**

